PATENT ABSTRACTS OF JAPAN

(54) METHOD AND DEVICE FOR SUPPORTING DESIGN OF GEAR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a gear design supporting method, with which a gear mechanism is not expanded too much or cost is not increased by previously grasping the dynamic motion of a gear mechanism system.

SOLUTION: Concerning the gear design supporting method for analyzing and calculating the dynamic motion of a shaft to be driven corresponding to the motion of a driving shaft by modeling a gear transmission mechanism system installed between the driving shaft and the shaft to be driven, the various element information of basic various elements of a gear and driving condition information are applied (S1), the state of engaging the teeth of the gear is found by using these element information and driving condition information (S3), the contact rigidity value between gears is time sequentially set corresponding to a change in that engaging state (S4), the dynamic motion of the shaft to be driven is calculated by time sequentially solving the equation of motion on the basis of the contact rigidity value (S5-S9) and the calculated operation analyzed result of the driving shaft and the shaft to be driven is outputted (S10).
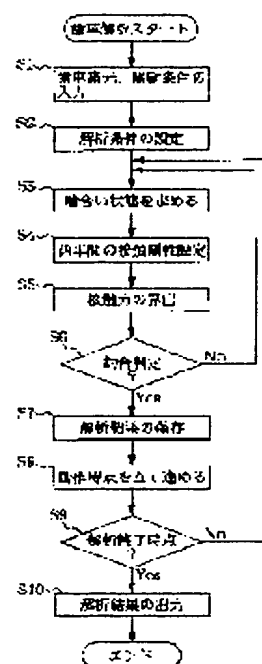
LEGAL STATUS

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A.   Relevance of the Above-identified Document

This document has relevance to claims <u>1, 4 and 7</u> of the present application.

B. Translation of the Relevant Passages of the Document

[ABSTRACT]

[MEANS TO ACHIEVE THE OBJECT]

The present invention provides a method for assisting gear designing based on modeling of a gear transmission mechanism between a driving axis and a follower driving axis, so as to evaluate and calculate a dynamic behavior of the follower driving axis with respect to a movement of the driving gear, the method including: feeding information of basic characteristics and driving conditions of gears (S1); determining a state of gear engagement of the gears based on the information of basic characteristics and driving conditions (S3); finding a contact rigidity value between the gears in time series according to changes in the state of gear engagement (S4); calculating an equation of motion in time series based on the contact rigidity value (S5-S9); and outputting a result of calculation evaluating an operation of the driving axis

and the follower driving axis (S10).

[CLAIMS]

[Claim 1]

A method for assisting gear designing based on modeling of a gear transmission mechanism between a driving axis and a follower driving axis, so as to evaluate and calculate a dynamic behavior of the follower driving axis with respect to a movement of the driving gear,

said method comprising the steps of:

feeding information of basic characteristics and driving conditions of gears;

determining a state of gear engagement of the gears based on the information of basic characteristics and driving conditions;

finding a contact rigidity value between the gears in time series according to changes in the state of gear engagement;

calculating an equation of motion in time series based on the contact rigidity value; and

outputting a result of calculation evaluating an operation of the driving axis and the follower driving axis.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[FIELD OF THE INVENTION]

The present invention relates to evaluation methods

and evaluation devices for use in designing of a gear mechanism, and particularly to a method and device for assisting gear designing that enable one to check a potential problem in the gear mechanism by estimating its transmission characteristics in a simulated operation based on information of basic characteristics and driving conditions of the gears.

[0006]

[FUNCTIONS]

... The invention feeds information of basic characteristics and driving conditions of gears, determines a state of gear engagement of the gears based on the information of basic characteristics and driving conditions, finds a contact rigidity value between the gears in time series according to changes in the state of gear engagement, calculates an equation of motion in time series based on the contact rigidity value, and outputs a result of calculation evaluating an operation of the driving axis and the follower driving axis...

[EMBODIMENTS]

... Note that, examples of the basic specification information include the number of teeth in the gear, module, pressure angle, tooth width, material, moment of inertia, and center distance. The information of driving condition includes, for example, information concerning

the initial angle of the driving gear (direction of the gear when it is first brought into contact with the mating gear), and information concerning driving torque...

[0008]

... That is, it is determined whether the difference between the driving torque and the corresponding value in the left-hand side of the equation, and the difference between the load torque and the corresponding value in the left-hand side of the equation fall within the acceptable evaluation range of error set in S2...

[0009]

If the forces do not balance out (No in S6), the angle (direction) of the follower gear is slightly changed to find a state of gear engagement again (S3 through S6). On the other hand, if the forces do balance out (Yes in S6), the result of evaluation, such as speed, currently determined is stored (S7), and the operation point is advanced by Δt (increment determined as an evaluation step) (S8). In S9, it is determined whether the result of evaluation currently stored is for the last operation point in the current evaluation period. If no in S9, the evaluation is repeated from S3. If the evaluation is finished for the current evaluation period (Yes in S9), the result of evaluation currently stored, such as the speed at each operation point, is outputted in the form of a graph or table to the

CRT2 or the printer 6 (S10). The output result may be used by a designer to change the gear characteristics, driving torque, or the state of gear engagement, so as to reduce or increase the speed for a particular gear engagement causing the gears to rotate at an excessively high speed or slow speed. That is, the present embodiment enables a designer to predict the dynamic behavior of the gears, such as speed, at each operation point (rotational position) of the gear mechanism, thereby reducing fluctuations of speed, and attaining a target speed without requiring a large gear mechanism or increasing the cost therefor.

[0014]

[EFFECTS OF THE INVENTION]

... Based on the output calculation result for the operation evaluation of the driving axis and the follower driving axis, the dynamic behavior of the gear mechanism can be predicted to enable designing based on this prediction.

[DRAWINGS]

[FIGURE 2]

Start gear evaluation

S1 input gear characteristics and driving conditions

S2 Set evaluation conditions

S3   Determine a state of gear engagement

S4   Set contact rigidity between gears

S5   Calculate contact force

S6   Balance out?

S7   Store evaluation result

S8   Advance operation point by Δt

S9   End of evaluation?

S10 Output evaluation result

End